Chapter 12

Makerspaces: Materializing, Digitizing, and Transforming Learning

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ABSTRACT

The emergence of the makerspace movement offers tremendous potential to transform learning. Learning by making, while ancient in practice, has evolved due to the development and confluence of developments in computing, communications technologies, pedagogy, and library science. In particular, online networking has enabled learners to share and engage with ideas and materials in a uniquely 21st century fashion. The makerspace activity process (MAP) framework illustrates how makerspace activities—categorizing, relating, and creating—are intertwined through networking practices. Makerspaces are highly contingent and transformative; both the nature of the makerspace and the participants transform each other through interaction. For those educators who find it difficult to integrate within formal curricula and assessment practices, the MAP framework provides a guide for facilitating and assessing learner activity in educational makerspaces. The framework is useful for educators at all levels from kindergarten to post-secondary.

INTRODUCTION

Terms such as makerspace, hackerspace, and fablab have been permeating popular media for the past decade. The makerspace movement is now making its way into the discussions and literature of educational circles. A makerspace is a place where individuals can create new digital and/or physical things and develop skills in a collaborative environment that encourages discovery and problem-based learning (Fleming, 2015). In these spaces, people can engage in activities ranging from traditional crafts to cutting-edge electronics and digital creations. Upon first glance, a makerspace seems to be an undeni-
ably physical space; however, in this chapter we will argue that today’s makerspaces are unique because of networking technologies. In our view the ability to communicate and collaborate with others is at the core of transformation. Networking facilitates the curation, comprehension, and creation of ideas, materials, information, processes, and even learner identities. In our view, learning is highly iterative, contingent, and relational.

In this chapter, we will first provide an historic perspective on the makerspace movement. The historic developments in the fields of library science, computing, communications technologies, and pedagogy have all played a role in shaping the types of makerspaces seen today. The conceptual framework, the makerspace activity process (MAP), outlines the relationship between networking, curating, relating, and creating in today’s makerspaces. Finally, we will explore how teachers can integrate makerspace activities into their teaching practices.

**EMERGENCE OF THE MODERN MAKERSPACE**

The notion of craftwork and building things by hand is not new; people have always engaged in making things. Historic developments in library science, computing, and digital communications have shaped the nature of the makerspace movement and associated pedagogical practices. Table 1 provides a partial chronology of some relevant developments since the late 1800s.

Although the chronology in Table 1 is only partial, it helps articulate the relationship between libraries, computing, networking, and the evolution of makerspaces. For example, we can see that some libraries offered crafts and club activities as far back as 1870. In the 1960s, we see the rise of the computer age with the introduction of the UNIX operating system by AT&T Bell Laboratories and the first computer network developed by the United States military. In the late 1980s personal computers become affordable to the middle classes, particularly hobbyists. Around that time, terminology such as “information literacy” is adopted into the library science lexicon. It takes another 10 years for the World Wide Web to become accessible and editable to non-experts in the form of Hypertext Markup Language (HTML). From the 1990s, the speed of invention in computing and networking increases rapidly. There is evidence that computing and networking were becoming embedded in a larger expanse of activities. For example, in 1995, the MIT Media Lab began to explore how digital tools could be applied in what were previously physical, embodied activities such as wearable computing, artificial intelligence, and art. In the 2000s and 2010s the activities across the four areas of our timeline become increasingly interrelated. For example, the advent of the smartphone conflates activities by allowing people to access, share, and create content using a single device. Meanwhile, computer enthusiasts then begin to design, share, and sell new applications (“apps”) for the smartphones and tablet computers.

Pedagogy also has an interesting arc of development that is relevant to the maker movement. Learning through doing is an important feature of the maker-movement ethos, but again it is by no means a new idea. The maker movement traces its roots primarily to the ideas of John Dewey and Seymour Papert. In the early 1900s, Dewey encouraged learners to experiment and play in order to build upon prior knowledge, to learn how to handle uncertainty in problem solving, and to connect school-learning with the real world (Bevan, Gutwill, Petrich & Wilkinson, 2014; Bransford, 2000; Dougherty, 2012; Libow Martinez & Stager, 2016).

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